

FULL REVIEW

Full Review — Two-Dimensional Kinematics with Components — Algebra-Based

Review the essential ideas, relationships, and problem-solving tools for Two-Dimensional Kinematics with Components.

 TIME 45–60 minutes	 BEST FOR A complete topic review	 FINISH WITH A readiness check
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After this full review, you'll be able to...

recall the essential ideas, apply them to representative problems, and determine what to study next.

HOW TO USE THIS GUIDE

Work through the stages in order. Write directly in the spaces provided, check your work in the Solutions section, and finish by choosing the next resource that matches your confidence.

Choose how you want to review: work through this guide, follow the online review, or watch the video review.

[Start the Review Online →](#)

[Watch the Video Review →](#)

YOU WILL NEED

Pencil or pen • Calculator if needed • Approximately 45–60 minutes

FR-02 • COURSE ALIGNMENT

Course Alignment

This Physics Sensei Topic Review is an independent learning resource. Use it to reinforce key concepts, prepare for homework, or review before a quiz or exam.

Related Unit Review: If you need to review the complete unit material, review [Motion in Two Dimensions here →](#)

RESOURCE: Physics Sensei Topic Review
TOPIC ID: MEC-U04-T01
TOPIC: Two-Dimensional Kinematics with Components
PARENT UNIT: MEC-U04 — Motion in Two Dimensions
COURSE LEVEL: Algebra-Based

BEST USED

- ✓ After learning the topic
- ✓ Before starting homework
- ✓ Before a quiz or exam

FR-03 • YOUR REVIEW PLAN

Your Review Plan

Complete these six stages in order. Each stage builds on the previous one and prepares you for the final readiness check.

6 stages • Approximately 45–60 minutes

1 Warm-Up Check Activate prior knowledge.	2 Core Concepts Review the essential ideas.	3 Guided Practice Apply what you learned.
4 Confidence Check Confirm your understanding.	5 Summary Review the key ideas.	6 Next Step Continue your learning.

PRINTING TIP

For student copies, print double-sided and keep the Solutions section after the student activities so learners attempt each activity before checking their work.

FR-04 • STAGE 1 OF 6

Warm-Up Check

Before you begin, take a moment to see what you already remember. Do not worry about getting everything right. This is only a starting point.

ACTIVITY 1**Recall Activity 1**

Answer before revealing the response.

A velocity of 18 m/s is directed 40° above $+x$. Write the component expressions.

ACTIVITY 2**Recall Activity 2**

Answer before revealing the response.

In a two-dimensional constant-acceleration problem, which variable must be identical in the x and y equations?

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Answer before revealing the response.

A velocity has components -5 m/s and 12 m/s. What is its speed?

Ready to strengthen your understanding?

You've refreshed what you already know. Next, reinforce the essential concepts that will help you solve problems with confidence.

Continue to Core Concepts →

FR-05 • STAGE 2 OF 6

Core Concepts

Let's rebuild the key ideas one step at a time. Focus on understanding the relationships before worrying about solving problems.

KEY CONCEPT 1

Resolving vectors with trigonometry

Two-dimensional kinematics begins by expressing each vector in components along chosen axes. When θ is measured from $+x$, cosine gives the horizontal magnitude and sine gives the vertical magnitude. Signs are assigned from the actual directions, not from the trig functions alone.

$$\text{horizontal component} = v \cos \theta; \text{vertical component} = v \sin \theta$$

EXAMPLE A 20 m/s velocity at 30° above $+x$ has components 17.3 m/s and 10.0 m/s.

SENSEI NOTE Draw a small component triangle before calculating. It prevents swapped sine/cosine factors and sign errors.

KEY CONCEPT 2

Constant-acceleration equations on each axis

Use the one-dimensional constant-acceleration equations separately in x and y . One axis may have zero acceleration while the other has a nonzero value. The elapsed time is common to both axes and is often the variable that connects the two component solutions.

$$\text{component displacement} = \text{initial component velocity} \times t + \frac{1}{2}(\text{component acceleration})t^2$$

EXAMPLE With initial horizontal velocity 6 m/s and horizontal acceleration 2 m/s^2 , the horizontal displacement after 4 s is 40 m.

SENSEI NOTE Use component values in component equations; do not substitute the total speed for an axis velocity.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Reconstructing magnitude and direction

After component velocities or displacements are known, recombine them to describe the overall vector. Use the Pythagorean relationship for magnitude. Direction follows from the component signs and a trigonometric angle, with quadrant interpretation included.

$$\text{vector magnitude} = \sqrt{[(\text{horizontal component})^2 + (\text{vertical component})^2]}$$

EXAMPLE Components -6 and 8 have magnitude 10 ; the vector lies in quadrant II relative to $+x$.

SENSEI NOTE An inverse-tangent calculator output alone does not encode the correct quadrant; check the component signs.

Ready to apply these ideas?

You've reinforced the essential concepts. Now put them into practice by working through guided examples and building your problem-solving confidence.

[Continue to Guided Practice →](#)

FR-06 • STAGE 3 OF 6

Guided Practice

Now it's time to apply what you've reviewed. Work through each activity in order. The examples become gradually more challenging, and each prepares you for the final readiness check.

PRACTICE 1**Worked Example**

Resolve the initial velocity and carry both components through the calculation.

An object starts at 16 m/s, 30° above $+x$. Use $\cos 30^\circ \approx 0.866$ and $\sin 30^\circ = 0.500$. Find the initial velocity components.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Use component acceleration equations with a shared time.

Initial velocity components are 4 m/s and 6 m/s. Acceleration components are 3 m/s² and -2 m/s². Find the displacement components after 3 s.

PRACTICE 3

Independent Problem

Find the final velocity components, then recombine them.

Initial velocity components are 2 m/s and 8 m/s. Acceleration components are 1 m/s² and -2 m/s². Find the velocity components and speed after 2 s.

Ready to check your understanding?

You've practiced the essential skills with guidance. Now solve a few short problems on your own and confirm you're ready to move forward.

Continue to Confidence Check →

FR-07 • STAGE 4 OF 6

Confidence Check

You've rebuilt the key ideas and practiced them with guidance. Now try these short questions on your own to check your understanding before moving on.

QUICK CHECK 1**Component decomposition**

Resolve using the angle from $+x$.

A 25 m/s vector is 37° above $+x$. Use $\cos 37^\circ \approx 0.80$ and $\sin 37^\circ \approx 0.60$. Find its components.

QUICK CHECK 2**Shared-time displacement**

Apply the displacement equation on each axis.

Initial component velocities are 3 m/s and -1 m/s; acceleration components are 2 m/s^2 and 4 m/s^2 . Find the displacement components after 2 s.

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Magnitude and quadrant

Use the component signs and Pythagorean magnitude.

A velocity has components -9 m/s and 12 m/s. Find its speed and state its quadrant.

HOW DID IT GO?

I answered ____ of 3 questions correctly.

Use the Solutions section to check your reasoning, then take one final look at the essential ideas.

You've checked your understanding.

Take one final look at the essential ideas before deciding what to do next.

Continue to Summary →

FR-08 • STAGE 5 OF 6

Summary

Before moving on, take one final look at the most important ideas from this review.

KEY TAKEAWAY 1**Resolve vectors deliberately**

Use the stated angle and axis directions to produce signed components before doing kinematics.

KEY TAKEAWAY 2**Run one-dimensional kinematics twice**

The same constant-acceleration equations apply independently on x and y , linked by one shared elapsed time.

KEY TAKEAWAY 3**Recombine with geometry**

Use component magnitude and signs to recover the overall vector and its direction.

MY ONE-SENTENCE SUMMARY

In my own words, the most important idea is:

Ready for your next step?

You've reviewed the essential ideas one last time. Now choose the resource that best matches how confident you feel.

Continue to Next Step →

ANSWER KEY • CHECK AFTER ATTEMPTING

Solutions and Explanations

Use these solutions to check your reasoning—not only your final answer. Compare your approach with the concise reasoning below.

WARM-UP • ACTIVITY 1**Recall Activity 1**

Horizontal expression: $18 \cos 40^\circ$; vertical expression: $18 \sin 40^\circ$.

WHY IT WORKS Resolve the vector using trig ratios defined by the angle from +x.

WARM-UP • ACTIVITY 2**Recall Activity 2**

Elapsed time must be the same for both axis equations describing the same event interval.

WHY IT WORKS One physical interval supplies the same t to both scalar component equations.

WARM-UP • ACTIVITY 3**Recall Activity 3**

Speed = $\sqrt{(-5)^2 + 12^2} = 13 \text{ m/s}$.

WHY IT WORKS Magnitude uses perpendicular components, so the Pythagorean relation applies.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Worked Example

Initial velocity components are approximately 13.9 m/s horizontally and 8.0 m/s vertically.

WHY IT WORKS Resolve the 16 m/s vector before doing any axis-specific kinematics.

PRACTICE 2

Guided Problem

Horizontal displacement = $4(3) + \frac{1}{2}(3)(3^2) = 25.5$ m; vertical displacement = $6(3) + \frac{1}{2}(-2)(3^2) = 9$ m.

WHY IT WORKS Apply the displacement equation separately to the two signed component data sets.

PRACTICE 3

Independent Problem

After 2 s, components are 4 m/s and 4 m/s; speed = $\sqrt{4^2 + 4^2} \approx 5.66$ m/s.

WHY IT WORKS Update each velocity component separately, then calculate the vector magnitude.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Component decomposition

Components are 20 m/s horizontally and 15 m/s vertically.

WHY IT WORKS Use the supplied sine and cosine values for the 25 m/s vector.

QUICK CHECK 2

Shared-time displacement

Horizontal displacement = $3(2) + \frac{1}{2}(2)(2^2) = 10$ m; vertical displacement = $-1(2) + \frac{1}{2}(4)(2^2) = 6$ m.

WHY IT WORKS Both component displacements use the same 2 s interval.

QUICK CHECK 3

Magnitude and quadrant

Speed = 15 m/s; negative horizontal and positive vertical components place the vector in quadrant II.

WHY IT WORKS Magnitude is 15; the signs determine quadrant II.

READINESS GUIDE

3 correct: You're ready to continue. • 2 correct: Review the missed idea, then continue. • 0–1 correct: Revisit Core Concepts or choose more practice.

FR-09 • STAGE 6 OF 6

Next Step: Continue Learning

Great work! You've completed this review. Choose the next resource that best matches how confident you feel.

 I'm Still Unsure Review the key ideas and examples again. Review Again →	 I Need More Practice Continue with additional practice for this topic. Go to Practice →	 I'm Ready Continue to the next recommended resource. Continue →
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RECOMMENDED LINKS

[Review this topic again →](#)[Find additional practice →](#)[Choose another type of physics help →](#)

Continue reviewing with these companion resources.

[Start the Review Online →](#)[Watch the Video Review →](#)

PHYSICS HELP THAT MAKES SENSE

A Physics Sensei review never ends at the last question. It always guides you toward the next useful step.

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